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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,203	09/29/2003	Nicholas I. Buchan	HSJ920030156US1	9945

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INTELLECTUAL PROPERTY LAW OFFICE
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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/675,203

Applicant(s)

BUCHAN ET AL.

Examiner

Patricia A. George

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 9/29/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-20, are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The word "MORE" is subjective and indefinite and "... " is vague and indefinite. It is unclear what specific metals are encompassed by the term "...MORE"

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1 and 5-10 are rejected under 35 U.S.C. 103(a) as being obvious over Halahan et al. (USPN 6,897,148) in view of Siniaguine et al. (USPN 6498074).

As for claim 1, Halahan et al. discloses a method for fabricating heads of disk drive assemblies, comprising a Si wafer (FIG. 4, 110) which has been fabricated with a

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SiO.sub.2 overcoat (120); depositing a layer of DRIE-resistant material (FIG. 15, 1010.1) on said SiO.sub.2 overcoat (120); depositing a patterned layer of RIE-resistant material (1010.3) on said layer of DRIE-resistant material to form a primary mask.

Halahan discloses etching by RIE (fig. 15 and col.8, l.21-24, col.10, l.5-6) through said primary mask (fig. 15, 1010.3) to pattern said SiO.sub.2 (fig. 15, 120) overcoat layer and said layer of DRIE-resistant material (fig. 15, 1010.1).

Halahan discloses removing said primary mask (fig. 15, 1010.3) to expose said layer of DRIE-resistant material (fig. 15, 1010.1) which has now been patterned to form a secondary mask (col.8, l.62-64); etching by DRIE through said secondary mask (fig. 15, 120) to cut said Si wafer (fig. 22 and fig 5, or col.4, l.15-25); and removing said secondary mask (fig. 15, 120).

Halahan discloses the use of DRIE to make a hole in a silicon wafer, but does not disclose cutting the wafer into pieces, as in claim 1.

Siniaguine et al. (USPN 6498074) teaches the wafer is diced only part of the way through, to form grooves which are at least as deep as the final thickness of each chip to be obtained from the wafer. Then the wafer has a backside plasma etch to first expose the cut grooves; remove damage from the chip sidewalls, that is formed in the cutting; and to round the chips' bottom edges and corners (ab.) Siniaguine teaches the method that includes the backside etch of a wafer for the completion of the cut, which smoothes the wafer edges which are damaged by laser or saw cutting, thus prolonging the life of the device (col.1, l.44-46). Siniaguine teaches another benefit with use of plasma etch to cut a wafer is that the grooves' aspect ratio

reduces
imperfections
- smoother edges - which leads
so that increases
life of chip

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is large enough to reduce the lateral etch rate of the chip sidewalls, allowing more area for on-chip circuitry (ab.).

It would have been obvious to one ordinary skill in the art at the time of invention was made ~~to include a cutting step as a separate~~ to combine the method of cutting wafers into individual pieces through RIE plasma etch, of Siniaguine, with the method of DRIE plasma etch, of Halahan, because Siniaguine teaches resolution of inherent sawing and laser limitations, such as chipping and generation of surface damage, while allowing more area for on-chip circuitry; and Halahan teaches use of DRIE cutting methods allow the very deep, high aspect ratio etching, in a short time, eliminates particles cause sawing and laser dicing, is commonly used, and commercially available. *direct*

As for claim 5, Halahan discloses the use of the DRIE-resistant material, is the SiO.sub.2 overcoat as the DRIE-resistant material (shown in fig. 16).

As for claim 6, Halahan discloses depositing a patterned layer of RIE-resistant material (fig. 10, 1010.3) on said layer of DRIE-resistant material (fig. 10, 1010.1) to form a primary mask comprises; applying, exposing and developing photo resist (col. 3, l.39-40) to create the pattern (col. 3, l.39 masked is written on pattern); plating the layer of RIE-resistant material into the photo-resist pattern (col. 7, l.42-25 "other process can also be used is written on plating the layer); and stripping the photo-resist (see fig. 16).

As for claim 7, Halahan discloses applying a seed layer (fig.16, 1010.3) of RIE-resistant material before applying said photo resist (fig. 16, 1110).

to modify the method of Halahan to include a step wherein the wafer is cut into pieces because the ~~second~~ reference of Siniaguine illustrates that it is beneficial to do so because

As for claim 8, Halahan discloses first sputter etching away said seed layer (col. 5, l. 33-35 "any suitable technique" is written on sputter-etching) of RIE-resistant material before RIE.

As for claims 9-10, Halahan discloses removing primary mask by selective wet etching (see col. 8, l. 10-11, in reference to col. 5, l. 34-36).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-4 are rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above) in view of Matono (USPN 6,477,019).

As for claims 2, 3, and 4, Halahan discloses RIE-resistant material (fig. 10, 1010.3) is a metal (col.7, l.35-40 - TiW).

Halahan did not choose from the claimed group consisting of Al.sub.2O.sub.3 for the RIE-resistant material.

Matono et al. teaches magnetic head device manufacturing methods (fig. 3), which includes the formation of numerous thin film magnetic head elements, including of a plurality of component layers, on wafers which are cut resulting in multiple individual head blocks pieces (col.2, l. 33-34). Matono teaches use of alumina (col. 6, l.60) for the

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magnetic gap layers (fig. 4, 8, 11, and 13) (magnetic gap layers are written on the overcoat). Matono teaches the layer of alumina can be selectively patterned vertically, when using reactive plasma methods (col. 2, 22-25).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to combine the method of cutting wafers into individual pieces using DRIE plasma etch, of Halahan and Siniaguine, with the use of alumina as a RIE resistant material (i.e. hard mask), as taught by Matono, because Matono teaches the layer of alumina can be selectively patterned vertically, when using reactive plasma methods (col. 2, 22-25).

Claim Rejections - 35 USC § 103

Claim 11 is rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above), in view of Matono (see discussion above) and Mandal et al. (USPN 6,171,945).

The combined teachings of Halahan and Siniaguine failed to teach etching by RIE through said RIE mask to pattern the SiO₂ overcoat layer and form a DRIE mask removing RIE mask to expose DRIE mask; from said DRIE-resistant material; etching by DRIE through said DRIE mask; removing DRIE mask.

Mandal et al. teaches etching by RIE (col. 17, l.61-62 "using conventional photolithography and etch processes" is written on RIE and DRIE) through said RIE (518) mask to pattern the SiO₂ overcoat layer (fig. 8F, part. 510) and form a DRIE mask (fig.8F, 514) removing RIE mask (fig.8F, 518, see fig. 8G for post removal) to

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expose DRIE mask (fig. 8G, 514); from said DRIE-resistant material (fig. 8G, 514); etching by DRIE through said DRIE mask (fig. 8G, 514); removing DRIE mask (col. 18, l.8-10).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify the plasma etch process used for dividing the wafer into a variety of pieces, of Halahan and Siniaguine, to include the well known dual damascene methods, of Mandal's invention, because it would reduce the number of steps needed for manufacturing while eliminating limitations of other processing techniques.

As for claims 12 - 13, Halahan discloses RIE-resistant material (fig. 10, 1010.3) is a transitional metal (col.7, l.35-40 - TiW) between group 2 elements and group 13 elements of the periodic table (see <http://www.chemicool.com/> for a periodic table).

As for claim 15, see discussion on claim 5 above.

As for claim 16, see discussion on claim 6 above.

As for claim 17, see discussion on claim 7 above.

As for claim 18, see discussion on claim 8 above.

As for claim 19, see discussion on claim 9 above.

As for claim 20, see discussion on claim 10 above.

Claim Rejections - 35 USC § 103

Claim 14 is rejected under 35 U.S.C. 103(a) as being obvious over Halahan and Siniaguine (see discussion above), in view of Matono (see discussion above), Mandal (see discussion above), and Sheplak et al (USPN 6018861).

Mandal teaches the hard mask is TiW, a transient metal, but does not specify other materials such as Cu, or NiFe, as listed in claim 14.

Sheplak et al. teaches a method of forming micro-sensor thin-film anemometer, in which copper is used as a hard mask (col.2, l.60-64). Sheplak teaches devices formed according to this method show a significant improvement.

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify the plasma etch process used for dividing the wafer into a variety of pieces, of Halahan and Siniaguine, to include use of a copper hard mask, of Sheplak, because Sheplak teaches a significant improvement to the device.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure is as follows: US 2002/0094663 A1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571) 272-5955. The examiner can normally be reached on weekdays between 7:00am to 4:30pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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NADINE G. NORTON
SUPERVISORY EXAMINER

